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## C-A OPERATIONS PROCEDURES MANUAL

### ATTACHMENT

#### 7.1.65.c Safety Issues Associated with Cold Boxes 1 & 2

C-A-OPM Procedures in which this Attachment is used.		
7.1.65		

#### Hand Processed Changes

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 Collider-Accelerator Department Chairman      Date

M. Sardzinski



## **SAFETY ISSUES ASSOCIATED WITH COLD BOX 1 and 2 OF THE RHIC 24 kW REFRIGERATOR**

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This document describes the safety issues associated with working inside cold box 1 and 2 of the 24 kW RHIC cryogenic refrigerator. It is not meant to cover the details of every job. A job specific work permit reviewed by appropriate personnel is still required to complete any work inside the cold box.

### **MECHANICAL SAFETY ISSUES**

#### **Component details**

Cold box 1 houses the heat exchanger HX 1A/2A,

Cold Box 2 houses the heat exchanger HX 1B/2B

#### **Confined Space.**

Cold Box 1 and Cold Box 2 are considered a confined space. Any work inside the box must adhere to the confined space regulations described in the BNL SBMS.

#### **Trapped Helium Volumes**

The potential exists for trapped pockets of high pressure helium inside the cold box. Prior to penetrating any process lines inside the box, contact the cryo control room at x3837 to verify no trapped helium volumes exists.

#### **Pressurized Helium Sources**

Cold Box 1 and Cold Box 2 are part of the RHIC cryogenic system and has the potential to see *pressurized Helium gas sources*. Following are a list of potential sources and the valves associated with isolating them (Reference drawings 3A995009 and 3A995048 ).

**Cold Box 1**

<b>H317M</b>	<b>High Pressure, 1-16atms. Compressor discharge</b>
<b>H316M</b>	<b>High Pressure, 1-16atms. Compressor discharge</b>
<b>H315M</b>	<b>High Pressure, 1-16atms. Compressor discharge</b>
<b>H422A</b>	<b>Low Pressure,1-3atms. Refrigerator return</b>
<b>H313M</b>	<b>Low Pressure, 1-3atms. From HX-3M</b>
<b>H314M</b>	<b>High Pressure, 1-16atms. To HX-3M</b>
<b>H324M</b>	<b>High Pressure 1-16atms. To turbine pods 1 or 2</b>
<b>H318M</b>	<b>Regeneration System</b>
<b>H319M</b>	<b>Regeneration System</b>
<b>H320M</b>	<b>Regeneration System</b>
<b>H321M</b>	<b>Regeneration System</b>
<b>H322M</b>	<b>Regeneration System</b>
<b>H324M</b>	<b>Regeneration System</b>
<b>H305M</b>	<b>Regeneration System</b>
<b>H306M</b>	<b>Regeneration System</b>
<b>H9195M</b>	<b>Regeneration System</b>
<b>H421M</b>	<b>Instrument Inlet Valve</b>

**Cold Box 2**

<b>H715M</b>	<b>High Pressure, 1-16atms. Compressor discharge</b>
<b>H716M</b>	<b>High Pressure, 1-16atms. Compressor discharge</b>
<b>H717M</b>	<b>High Pressure, 1-16atms. Compressor discharge</b>
<b>H822A</b>	<b>Low Pressure,1-3atms. Refrigerator return</b>
<b>H713A</b>	<b>Low Pressure, 1-3atms. From HX-3M</b>
<b>H714A</b>	<b>High Pressure, 1-16atms. To HX-3M</b>
<b>H724M</b>	<b>High Pressure 1-16atms. To turbine pods 1 or 2</b>
<b>H718M</b>	<b>Regeneration System</b>
<b>H719M</b>	<b>Regeneration System</b>
<b>H720M</b>	<b>Regeneration System</b>
<b>H721M</b>	<b>Regeneration System</b>
<b>H722M</b>	<b>Regeneration System</b>
<b>H723M</b>	<b>Regeneration System</b>
<b>H705M</b>	<b>Regeneration System</b>
<b>H706M</b>	<b>Regeneration System</b>
<b>H821M</b>	<b>Instrument Inlet Valve</b>

### **Helium Tube Trailers**

These are occasionally used to pressurize piping for leak checking or ASME pressure checking. Check with the cryo-control room (x3837) to verify there are no hazards associated with tube trailers prior to working inside the cold box.

### **Vacuum Systems**

The only issues associated with the vacuum system are locking out the vacuum pumps that are used to establish insulating vacuum. Details are in the electrical safety section. Before entering the cold box contact the C-AD vacuum group for assistance in isolating the vacuum system and breaking the vacuum space with air/nitrogen mixture.

Vacuum Isolation Valves: Cold Box1 1V504A	}	Vac. System 1
Cold Box 2 1-V554A		

### **Pneumatic Systems**

There are no valves or other equipment located on top of each Cold Box, all air operated valves are around the perimeter of the boxes or inside the refrigerator building. These valves are supplied with pressurized nitrogen or air at approximately 100 psig. Nitrogen valves can be isolated via manifolds located local to the cold box. Reference drawing RD3A995059.

### **Heights**

Work inside the cold box may involve climbing on process piping and working at elevated heights. Use harnessing and temporary scaffolding as necessary. Also care should be taken not to get tangled up in loose instrumentation wiring.

## **ELECTRICAL SAFETY ISSUES**

An investigation of all potential electrical sources in cold box 1 and 2 that could contribute to an accident occurrence was performed. Careful inspection of the two cold boxes indicates there are no feed- through(s) externally that contain high voltages that pass into the cold box. The only feed-through(s) that exist are for low-level instrumentation (temperature sensors). See pictures below for instrumentation feed-through(s) into cold box 1 and 2 ( Fig.1 and 2).



**Fig.1**  
**Instrumentation feed through with four connectors –Cold box 1**



**Fig.2**  
**Instrumentation feed through with four connectors –Cold box 2**

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### **Electrical Safety Issues continued (Vacuum Systems)**

There are diffusion vacuum pumps external to cold box's 1 and 2 that requires 480 volts AC. The pump for Cold box 1 is on a plug and when service is required it can simply be unplugged. No LOTO is required. The pump for Cold box 2 is hardwired into a safety switch and can be shutoff at the pump when service is required. The 480 volts for this vacuum system does not enter cold box 1 or 2. See the following figures for vacuum pumps.



480 Volt plug for Diffusion Pump can be unplugged for safe servicing.

**Fig.3 Cold Box1 diffusion pump**



480-volt shutoff switch for Diffusion pump can be turned off and LOTO for safe servicing.

**Fig.4 Cold Box 2 diffusion pump**

There are vacuum gauges external of Cold box 1 and 2 as shown in the picture below. None of these gauges have voltages that enter internally into either cold box 1 or Cold box 2.



**Fig.5 Vacuum Gauges Cold Box 1**



**Fig.6 Vacuum Gauge Cold Box 2**

There are slide valves that are associated with both cold box vacuum systems that require 120V AC Power for solenoid operation. The power cables are enclosed in a conduit and do not enter the cold boxes. See the pictures below for details.



**Fig.7 Slide Valves for Cold Box 1 and Cold Box 2**



120Volt AC power lines  
enclosed in a conduit

### Other external Cold Box Hardware

**Figure 8 Cold Box 1 and 2 (outside)**



**Figure 9 Typical MAN-DOOR (outside)**



**Note: There is no equipment on top each Cold Box.**



Valves H822A  
And H714A  
These valves are  
associated with Cold  
Box 2. Note: They  
require 120AC to  
operate the solenoids.

**Fig. 10 Isolation Valves**





**Fig. 11 High Pressure manual valves to Cold Box1 & 2**



**Fig. 12**

These valves are associated with Cold Box 1. Note: They require 120AC to operate the solenoids.

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**Supporting Documents and drawings:**

**RD3A995047 Interconnecting Piping Diagram**  
**RD3A995048 Cold Box #1 and #2 2-D P&ID**  
**RD3A995009 RHIC 25Kw Helium Refrigerator P&ID**